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AIR BAG SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an air bag system in an instrument panel in front of a front occupant seat.

More particularly, the air bag system can inflate to a designed inflation, even if there exists an obstacle near the instrument panel for restraining an occupant at a front seat. The present invention can provide less impact to the obstacle and maintain the occupant restraining performance, even if there exists no obstacle.

DESCRIPTION OF THE RELATED ART

The known air bag system includes a folded air bag housed in a storing portion, which is provided in an instrument panel in front of a front passenger seat. The air bag is inflated and inflated toward an occupant quickly by introducing high-pressure gas into the air bag, when a vehicle is crashed for restraining the forward movement of the occupant, which is caused by the inertia force.

The air bag needs to be inflated smoothly in case that an obstacle is near the instrument panel. For example, the obstacle is a child safety seat facing rearward relative to an inflating direction of the air bag. Even

if the air bag is brought into contact with the obstacle while the air bag is being inflated, the impact imparted to the obstacle by the air bag needs to be reduced. After the air bag is inflated, the configuration of the air bag needs to remain stable.

To cope with this, the following related methods have been used: (a) the air bag is inflated to avoid as much as possible a risk of contact with the obstacle in the inflating direction of the air bag by improving the method of housing the air bag; and (b) the configuration of the air bag is improved so as to avoid the contact with the obstacle when the air bag is inflated.

However, with the method under (a) there exist problems. One such problem is that the load inputted relative to the windshield becomes large when the air bag is inflated. A second problem is that the air bag is not inflated to the designed configuration due to the obstacle, whereby the passenger restraining performance is deteriorated. With the method under (b) there exist problems. One such problem is that the designed passenger restraining performance is deteriorated by the varied configuration after the inflation of the air bag.

SUMMARY OF THE INVENTION

It is an object of the invention that an air bag

system, which may eliminates the problems in the related art, is provided. The above-mentioned object can be achieved by inflating the air bag with a designed inflating configuration to restrain an occupant, even if there exists an obstacle near the instrument panel. Such an inflating configuration provides less impact to the obstacle and maintains a designed passenger restraining performance even if there exists no obstacle.

As a result of intensive studies to attain the object, the inventors have come to a conclusion that the aforesaid problems may be solved by an air bag system, comprising:

an air bag for placement in a folded state under an upper surface of an instrument panel, and for being inflated by an inflator, which is ignited by the signal from the acceleration sensor, when a vehicle is crashed,

wherein the air bag has a pocket disposed at a lower surface of the air bag when the air bag is inflated.

Moreover, in the air bag system hereof, the pocket is located in a position corresponding to a top portion of a child safety seat when the air bag is inflated.

In the air bag system, it is preferable that the location of the pocket corresponds to the location of a top portion of a child safety seat fixed as facing rearward of the vehicle. Since the top portion of the

child safety seat is accommodated in the pocket, the impact that would be imparted to the child safety seat can be relaxed appropriately. And the air bag can be inflated to the designed inflating configuration for restraining the occupant. It is preferable that the pocket is recessed when the air bag is inflated.

In the case that the pocket is designed as the recessed type, the pocket may be fixed to the inside of the upper surface of the air bag with a strap.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional view of a front passenger seat showing how an air bag according to an air bag system of the invention is inflated.

Fig. 2 is a cross-sectional view of a front passenger seat showing how an air bag according to an air bag system of the invention is inflated to the full extent.

Fig. 3 is a perspective view showing an air bag according to a first embodiment of the invention.

Fig. 4 is a perspective view showing an air bag according to another embodiment of the invention.

Fig. 5 is a perspective view showing an air bag according to a further embodiment of the invention.

Fig. 6 is a perspective view showing an air bag according to still another embodiment of the invention.

Fig. 7 is a perspective view showing an air bag according to yet another embodiment of the invention.

Fig. 8 is a perspective view showing an air bag according to another modified embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFFRRED EMBODIMENTS

An air bag system according to the invention will be described in detail below with reference to the attached drawings.

Fig. 1 is a cross-sectional view showing an example of the air bag system according to the invention which is in a inflating process. In this example of the air bag system, a child safety seat is mounted in a front passenger seat as facing rearward as an obstacle.

In Fig. 1, the air bag system 1 is housed in an upper portion of an instrument panel 11. The air bag system 1 comprises: an airtight container-like retainer 12 which opens to an upper surface of the instrument panel 11; and lids 13a and 13b which close an upper end opening portion of the retainer 12.

An inflator 14 and an air bag 15 are housed in the interior of the retainer 12. Namely, the interior of the retainer 12 constitutes a housing portion of the air bag in the interior of the retainer 12. The inflator 14 is a container which includes a gas generating agent such

as gun powder, and a gas generating agent ignited when a crash of a vehicle is detected through a deceleration of the vehicle. From the gas generating agent, high-pressure gas is rapidly expelled by igniting. In addition, the air bag 15 is a bag which opens at one end thereof. And the air bag 15 is joined airtight in such a manner that gas generated by the inflator is allowed to flow into the air bag 15.

When the vehicle is decelerated abruptly due to a crash or the like the deceleration of the vehicle is detected by an acceleration sensor or the like, and the gas generating agent in the inflator 14 is ignited, whereby a high-pressure gas is rapidly expelled from the inflator 14, and the air bag 15 is pressed against the lower surfaces of the lids 13a and 13b. The lids 13a and 13b then rotate upwardly to thereby open the upper end opening in the retainer 12, and the air bag 15 is inflated through the opening.

While a child safety seat 18 is fixed in a front passenger seat as facing rearward of the vehicle, since a top portion of the child safety seat 18 is accommodated at the position corresponding to the position of a pocket 16 formed in the air bag, the air bag is allowed to be inflated smoothly, without interference from the child safety seat.

The air bag 15 is made of an airtight and soft material such as a woven fabric of nylon. It is preferable that the air bag is formed into a bag-like configuration using polyamide yarns. In addition, it is preferable that heat-resistant rubber or silicone is coated on the inner side thereof.

The pocket 16 is preferably housed in the inside of the air bag, when the air bag 15 is housed within the retainer 12.

Fig. 2 is a cross-sectional view showing a state in which the air bag is inflated to the full extent. Since the top portion of the child safety seat 18 is fully accommodated in the pocket 16 formed in the air bag 15, the air bag 15 can retain the designed configuration thereof. In addition, since the top portion of the child safety seat 18 is accommodated in the pocket 16, the impact that would be imparted thereto when the air bag 15 is brought into contact with the child safety seat 18 is reduced. In addition, since the air bag 15 can take the designed configuration even if there exists no obstacle, the passenger restraining performance thereof can be maintained.

The pocket comprises a pocket bag portion and a pocket opening.

There is no limitation to the configuration of the

pocket bag portion. A first configuration, for example, is formed in narrowing shape from the pocket opening toward a bottom portion of the pocket bag portion. A second configuration, for example, is formed in a cylindrical shape, and the shape of the bottom portion of the pocket bag portion is similar to the pocket opening.

To be specific, taken for other examples are such configurations as a semi-cylindrical configuration, a cylindrical configuration with circular bottoms, a conical configuration, a rectangular prism-like configuration and a semi-oval configuration. In addition, it is preferable that the depth of the pocket bag portion be 5 to 30cm when the air bag is inflated to the full extent.

It is not preferable that the pocket depth is less than 5cm, because it would have little effect in protecting the obstacle. It is not preferable that the size of the air bag needs to be enlarged, such as if the depth thereof is more than 30cm.

While there is no limitation to the configuration of the pocket bag portion, slit-like, circular, rectangular and oval configurations are preferable. The pocket opening may be sized such that the top portion of a child safety seat is allowed to be accommodated in the air bag when the air bag is inflated. The area thereof

is preferably in the range from 450 to 900cm^2 when the air bag is inflated.

It is preferable that the pocket is located at a position corresponding to the location of the top portion of the child safety seat facing rearward of the vehicle, whereby an obstacle such as the top portion of the child safety seat can be protected smoothly when the air bag is inflated.

In addition, a material of the pocket bag portion may be the nylon woven fabric, which is similar to the material of the air bag. One other suitable material may be rubber, which has flexibility.

It is preferable that a pocket bag portion is made as a separate component, which is joined to the air bag to produce a pocket. The air bag includes a pocket opening in a lower panel of the air bag to make a pocket. Thereafter, the mouth portion of the pocket opening is joined to the mouth portion of the pocket bag portion. The joining method for connecting the mouth portions together can be implemented through a sewing method, a bonding method through thermal fusion, or an adhesive method. However, the sewing method is preferable to join the mouth portions together. A polyamide suture is preferably used for the sewing method. In addition, joining or sewing a plurality of panels together according to the configuration thereof

may produce the pocket bag portion.

An example of the air bag according to the invention will be described with reference to the attached drawings.

Fig. 3 is a perspective view showing an example of an air bag in which a recessed type pocket is formed therein when the air bag is inflated to the full extent. As shown in Fig. 3, the recessed type pocket denotes a pocket which is formed in such a manner as to enter the air bag when the air bag is inflated. The pocket of the air bag 2 comprises a longitudinal slit-like pocket opening 22 relative to a direction in which the air bag is inflated and a pocket bag portion 21 which is constructed by sewing two angled panels together. The pocket can be produced by forming the slit-like pocket opening 22 in a lower panel of the air bag and sewing together the mouth portion of the pocket opening portion 22 and the mouth portion of the pocket bag portion 21.

Furthermore, a vent hole (an exhaust hole) is preferably formed in the air bag for exhausting gas.

The impact that would be caused when the top portion of the child safety seat enters the pocket to be accommodated therein can be relaxed quickly by forming the vent hole in a side of the air bag in the vicinity of the pocket.

In this air bag 2, as shown in Fig. 3, vent holes

23a and 23b are formed in both sides of the air bag in the vicinity of the pocket.

Fig. 4 is a perspective view showing another example of an air bag in which a recessed type pocket is formed therein when it is inflated to the full extent. The pocket of the air bag 3 comprises a transverse slit-like pocket opening 32 formed relative to a direction in which the air bag is inflated and a pocket bag portion 31 which is constructed by sewing together two semi-cylindrical panels. The pocket can be produced by forming the slit-like opening 32 in the lower panel of the air bag and sewing together the mouth portion of the slit-like opening 32 and the mouth portion of the pocket bag portion 31.

Since the air bags are inflated with the slit-like pockets 22 and 32 remaining closed in a case where there exists no obstacle, the passenger restraining performance equivalent to that of the air bag with no pocket can be provided.

On the contrary, in case there exists an obstacle, since the pocket openings 22 and 32 are opened to accommodate therein the obstacle, the air bag can be inflated to the designed inflating configuration to restrain the passenger while the impact to the obstacle can be relaxed appropriately.

Fig. 5 is a perspective view of an example of an air bag in which a recessed type semi-cylindrical pocket is formed in the air bag when it is inflated to the full extent. The pocket of the air bag 4 can be produced by forming a rectangular pocket opening 42 in the lower panel of the air bag and sewing a rectangular panel 41 to longer sides of the pocket opening 42 and both side panels as shown in Fig. 5.

Fig. 6 is a perspective view showing another example of an air bag in which a recessed type pocket is formed in the air bag when it is inflated to the full extent. The pocket of the air bag 5 comprises a circular pocket opening 52 and a pocket bag portion 51 which is formed into a conical configuration. The pocket can be produced by forming the circular opening 52 in the lower panel of the air bag and sewing the mouth portion of the circular opening 52 and the mouth portion of the pocket bag portion 51 together.

In addition, in the case of the recessed type pocket, it is preferable to fix the pocket bag portion and the inside of the upper panel in order to make stable the configuration of the recessed type pocket. It is preferable to use a strap to implement the aforesaid fixation. Fig. 7 is a perspective view of an example of an air bag in which a pocket opening 62 is formed into

a longitudinal slit-like configuration when the air bag is inflated to the full extent and in which a recessed type pocket bag portion 61 is fixedly sewed to the inside of an upper panel of the air bag via a strap 63. The pocket can be produced by fixedly sewing the pocket bag portion 61 provided with the strap 63 to the inside of the upper panel of the air bag, forming the slit-like opening 62 in the lower panel of the air bag and sewing together the mouth portion of the slit-like opening 62 and the mouth portion of the pocket bag portion 61.

It is preferable that the strap 63 is sewed to a bottom portion of the recessed type pocket bag portion 61 at one end thereof, and at the other end thereof in the vicinity of the pocket, it is preferred that the strap be sewn to the inside of the upper panel of the air bag.

While it is preferable that the pocket becomes recessed when the air bag is inflated, the pocket may become protruded when the air bag is inflated. As has been described before, the pocket is accommodated in the state in which it is contained inside the air bag in the state in which the air bag is folded up in the retainer. Consequently, the air bag in which the pocket becomes protruded is an air bag in which the pocket accommodated in the interior of the air bag is reversed to become protruded when the air bag is inflated, in case there

exists no obstacle. However, in case a child safety seat, for example, is placed facing rearward in the front passenger seat, since the air bag is brought into contact with the top portion of the child safety seat in the inflating process before the pocket is protruded, the pocket is thereby be forced into the air bag, and the air bag can be inflated while the impact to the child safety seat is minimized.

Fig. 8 is a perspective view showing an example of an air bag in which a protruded type pocket is formed in the air bag when it is inflated. The pocket of the air bag 7 comprises a pocket opening 72 which is formed into a longitudinal slit-like configuration relative to a direction in which the air bag is inflated and a pocket bag portion 71 which is constructed by sewing together two angled panels. The pocket can be produced by forming the slit-like opening 72 in the lower panel of the air bag and sewing together the mouth of the slit-like opening 72 and the mouth portion of the pocket bag portion 71.

It is preferable to form a vent hole (an exhaust hole) even in the air bag in which the protruded type pocket is formed as the impact resulting when the top portion of the child safety seat is accommodated in the air bag can be relaxed quickly.

Note that while the embodiments of the invention

have been described with the child safety seat being placed to face rearward as an obstacle, the invention is not limited thereto. According to the invention, even in case the child stands near the instrument panel, the air bag can be inflated while reducing the impact to the child.

Thus, while the air bag system according to the invention has been described with reference to the appended drawings, the invention is not limited thereto, and various modifications can be made to the air bag system without departing from the spirit and scope of the invention.

As has been described in detail, with the air bag system according to the invention, since the pocket is formed in the lower surface of the air bag when it is inflated, even if an obstacle exists near the instrument panel, the obstacle can be received in the pocket, and therefore the air bag can be inflated to the desired inflating configuration to thereby restrain the passenger as designed, and the impact to the obstacle can also be reduced. In addition, even if there exists no obstacle, the designed passenger restraining performance can be maintained. The air bag system according to the invention may preferably be used as a front passenger air bag system.